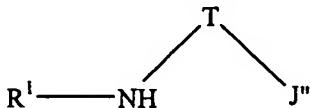
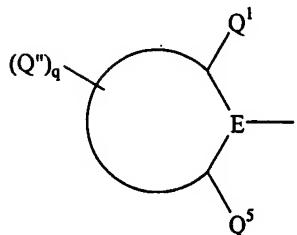


What is claimed is:

- 1 1. A composition comprising:
 - 2 (1) a ligand characterized by the following general formula:



3 wherein R¹ is characterized by the general formula:



4 wherein E is either carbon or nitrogen,

5 Q¹ and Q⁵ are substituents on the R¹ ring at a position ortho to E, with Q¹ and Q⁵ independently selected from the group consisting of alkyl, substituted alkyl, cycloalkyl, substituted cycloalkyl, aryl, substituted aryl and silyl, but provided that Q¹ and Q⁵ are not both methyl;

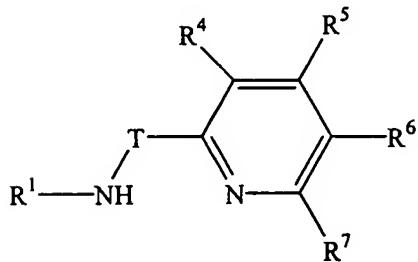
6 Q''_q represents additional possible substituents on the ring, with q being 1, 2, 3, 4 or 5 and Q'' being selected from the group consisting of hydrogen, alkyl, substituted alkyl, cycloalkyl, substituted cycloalkyl, heteroalkyl, substituted heteroalkyl, heterocycloalkyl, substituted heterocycloalkyl, aryl, substituted aryl, heteroaryl, substituted heteroaryl, alkoxy, aryloxyl, silyl, boryl, phosphino, amino, thio, seleno, halide, nitro, and combinations thereof;

7 T is a bridging group selected group consisting of -CR²R³- and -SiR²R³- with R² selected from the group consisting of hydrogen, alkyl, substituted alkyl, cycloalkyl, substituted cycloalkyl, heteroalkyl, substituted heteroalkyl, heterocycloalkyl, substituted heterocycloalkyl, aryl, substituted aryl, heteroaryl, substituted heteroaryl, alkoxy, aryloxyl, silyl, boryl, phosphino, amino, thio, seleno, halide, nitro, and combinations thereof; R³ selected from the group consisting of aryl, substituted aryl, heteroaryl, and substituted heteroaryl; and provided that R² is different from R³;

8 J'' is selected from the group consisting of heteroaryl and substituted heteroaryl;

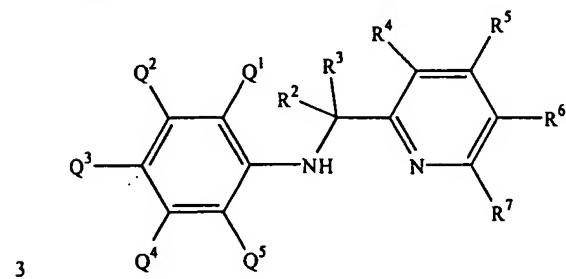
24 (2) a metal precursor compound characterized by the general formula $M(L)_n$ wherein
25 M is either hafnium or zirconium and each L is independently selected from the group
26 consisting of halide, alkyl, substituted alkyl, cycloalkyl, substituted cycloalkyl, heteroalkyl,
27 substituted heteroalkyl heterocycloalkyl, substituted heterocycloalkyl, aryl, substituted aryl,
28 heteroaryl, substituted heteroaryl, alkoxy, aryloxy, hydroxy, boryl, silyl, amino, amine,
29 hydrido, allyl, diene, seleno, phosphino, phosphine, carboxylates, thio, 1,3-dionates, oxalates,
30 carbonates, nitrates, sulphates, ethers, thioethers and combinations thereof or optionally two
31 or more L groups are joined into a ring structure; n is 1, 2, 3, 4, 5, or 6; and
32 (3) optionally, at least one activator.

1 2. The composition of claim 1, wherein said ligand is characterized by the formula:



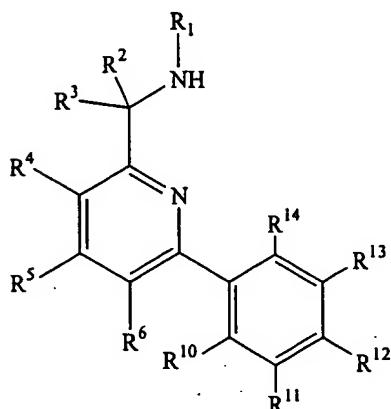
2 3. wherein each of R⁴, R⁵, R⁶ and R⁷ is independently selected from the group consisting of
3 hydrogen, alkyl, substituted alkyl, cycloalkyl, substituted cycloalkyl, heteroalkyl, substituted
4 heteroalkyl, heterocycloalkyl, substituted heterocycloalkyl, aryl, substituted aryl, heteroaryl,
5 substituted heteroaryl, alkoxy, aryloxy, silyl, boryl, phosphino, amino, thio, seleno, halide,
6 nitro, and combinations thereof; and optionally, any combination of R¹, R², R³, R⁴, R⁵, R⁶ or
7 R⁷ may be joined together in a ring structure.

1 3. The composition of claim 2, wherein said ligand is characterized by the
2 general formula:



4 such that E is carbon and wherein Q², Q³ and Q⁴ are independently selected from the group
5 consisting of hydrogen, alkyl, substituted alkyl, cycloalkyl, substituted cycloalkyl,
6 heteroalkyl, substituted heteroalkyl, heterocycloalkyl, substituted heterocycloalkyl, aryl,
7 substituted aryl, heteroaryl, substituted heteroaryl, alkoxy, aryloxy, silyl, boryl, phosphino,
8 amino, thio, seleno, nitro, and combinations thereof; optionally two or more of Q², Q³ and Q⁴
9 are joined together in a ring structure.

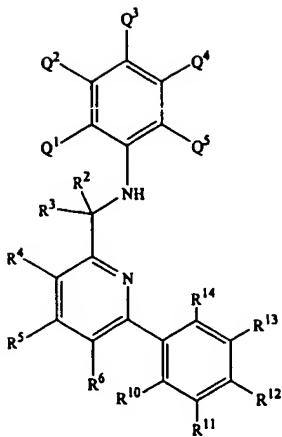
1 4. The composition of claim 2, wherein said ligand is characterized by the
2 general formula:



3
4 such that T is $-CR^2R^3-$ and wherein R¹⁰, R¹¹, R¹² and R¹³ are each independently selected
5 from the group consisting of hydrogen, halide, alkyl, substituted alkyl, cycloalkyl, substituted
6 cycloalkyl, heteroalkyl, substituted heteroalkyl, heterocycloalkyl, substituted heterocycloalkyl,
7 aryl, substituted aryl, heteroaryl, substituted heteroaryl, alkoxy, aryloxy, silyl, boryl,
8 phosphino, amino, thio, seleno, nitro, and combinations thereof; optionally, two or more R¹⁰,
9 R¹¹, R¹² and R¹³ groups may be joined to form a fused ring system having from 3-50 non-
10 hydrogen atoms; and

11 R¹⁴ is selected from the group consisting of hydrogen, alkyl, substituted alkyl,
12 cycloalkyl, substituted cycloalkyl, heteroalkyl, substituted heteroalkyl, heterocycloalkyl,
13 substituted heterocycloalkyl, aryl, substituted aryl, heteroaryl, substituted heteroaryl, alkoxy,
14 aryloxy, silyl, boryl, phosphino, amino, thio, seleno, halide, nitro, and combinations thereof.

1 5. The composition of claim 4, wherein said ligand is characterized by the formula:

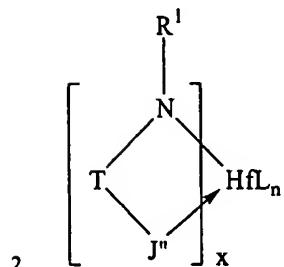


2

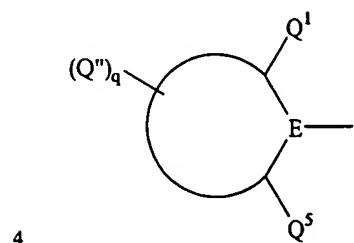
3 such that E is carbon and wherein Q², Q³ and Q⁴ are independently selected from the group
4 consisting of hydrogen, alkyl, substituted alkyl, cycloalkyl, substituted cycloalkyl,
5 heteroalkyl, substituted heteroalkyl, heterocycloalkyl, substituted heterocycloalkyl, aryl,
6 substituted aryl, heteroaryl, substituted heteroaryl, alkoxy, aryloxy, silyl, boryl, phosphino,
7 amino, thio, seleno, nitro, and combinations thereof; optionally two or more of Q², Q³ and Q⁴
8 are joined together in a ring structure.

1 6. The composition of either of claims 1, 2, 3, 4 or 5 wherein M is hafnium.

1 7. A metal-ligand complex characterized by the following formula:



2 3 wherein R¹ is characterized by the general formula:



4 5 wherein E is either carbon or nitrogen,

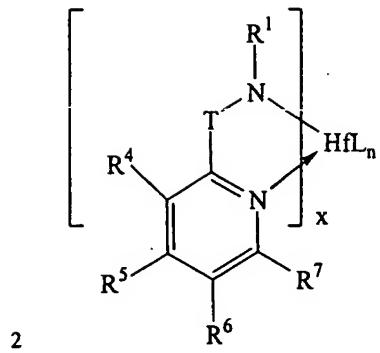
6 Q¹ and Q⁵ are substituents on the R¹ ring at a position ortho to E, with Q¹ and Q⁵
7 being independently selected from the group consisting of alkyl, substituted alkyl, cycloalkyl,
8 substituted cycloalkyl, aryl, substituted aryl and silyl, but provided that Q¹ and Q⁵ are not
9 both methyl;

10 Q"_q represents additional possible substituents on the ring, with q being 1, 2, 3, 4 or 5
11 and Q" being selected from the group consisting of hydrogen, alkyl, substituted alkyl,
12 cycloalkyl, substituted cycloalkyl, heteroalkyl, substituted heteroalkyl, heterocycloalkyl,
13 substituted heterocycloalkyl, aryl, substituted aryl, heteroaryl, substituted heteroaryl, alkoxy,
14 aryloxy, silyl, boryl, phosphino, amino, thio, seleno, halide, nitro, and combinations thereof;

15 T is a bridging group selected group consisting of -CR²R³- and -SiR²R³- with R²
16 selected from the group consisting of hydrogen, alkyl, substituted alkyl, cycloalkyl,
17 substituted cycloalkyl, heteroalkyl, substituted heteroalkyl, heterocycloalkyl, substituted
18 heterocycloalkyl, aryl, substituted aryl, heteroaryl, substituted heteroaryl, alkoxy, aryloxy,
19 silyl, boryl, phosphino, amino, thio, seleno, halide, nitro, and combinations thereof; R³
20 selected from the group consisting of aryl, substituted aryl, heteroaryl, and substituted
21 heteroaryl; and provided that R² is different from R³;

22 J" is selected from the group consisting of heteroaryl and substituted heteroaryl;
23 each L is independently selected from the group consisting of halide, alkyl,
24 substituted alkyl, cycloalkyl, substituted cycloalkyl, heteroalkyl, substituted heteroalkyl
25 heterocycloalkyl, substituted heterocycloalkyl, aryl, substituted aryl, heteroaryl, substituted
26 heteroaryl, alkoxy, aryloxy, hydroxy, boryl, silyl, amino, amine, hydrido, allyl, diene, seleno,
27 phosphino, phosphine, carboxylates, thio, 1,3-dionates, oxalates, carbonates, nitrates,
28 sulphates, ethers, thioethers and combinations thereof or optionally two or more L groups are
29 joined into a ring structure; n is 1, 2, 3, 4, 5, or 6; and x is 1.

1 8. The metal complex of claim 7 having the formula:

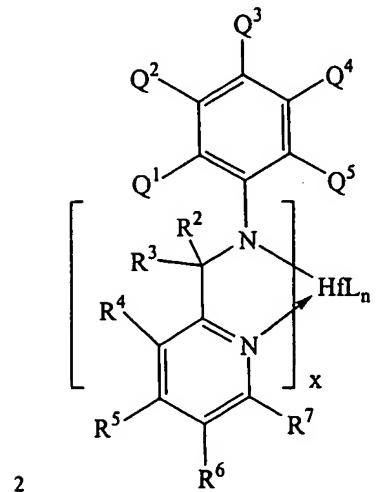


3

3 wherein each of R⁴, R⁵, R⁶ and R⁷ is independently selected from the group consisting of
4 hydrogen, alkyl, substituted alkyl, cycloalkyl, substituted cycloalkyl, heteroalkyl, substituted
5 heteroalkyl, heterocycloalkyl, substituted heterocycloalkyl, aryl, substituted aryl, heteroaryl,
6 substituted heteroaryl, alkoxy, aryloxy, silyl, boryl, phosphino, amino, thio, seleno, halide,
7 nitro, and combinations thereof; and optionally, any combination of R¹, R², R³, R⁴, R⁵, R⁶ or
8 R⁷ may be joined together in a ring structure.

1

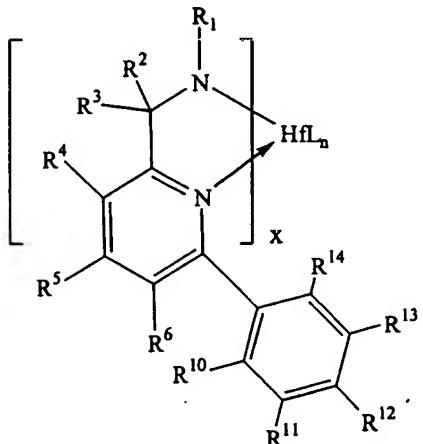
9. The metal complex of claim 8 having the formula:



3

such that E is carbon and wherein Q², Q³ and Q⁴ are independently selected from the group consisting of hydrogen, alkyl, substituted alkyl, cycloalkyl, substituted cycloalkyl, heteroalkyl, substituted heteroalkyl, heterocycloalkyl, substituted heterocycloalkyl, aryl, substituted aryl, heteroaryl, substituted heteroaryl, alkoxy, aryloxy, silyl, boryl, phosphino, amino, thio, seleno, nitro, and combinations thereof; optionally two or more of Q², Q³ and Q⁴ are joined together in a ring structure.

1 10. The metal complex of claim 8, wherein said complex is characterized by the formula:

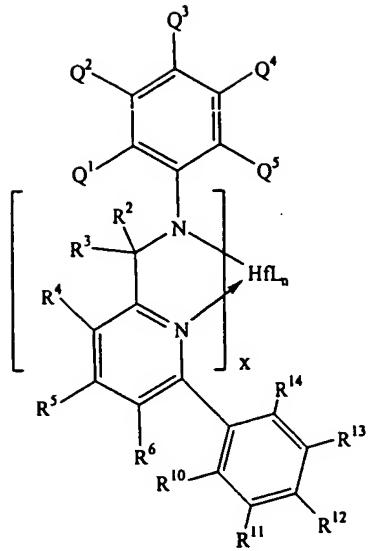


2

3 such that T is $-CR^2R^3-$ and wherein R^{10} , R^{11} , R^{12} and R^{13} are each independently selected
4 from the group consisting of hydrogen, halide, alkyl, substituted alkyl, cycloalkyl, substituted
5 cycloalkyl, heteroalkyl, substituted heteroalkyl, heterocycloalkyl, substituted heterocycloalkyl,
6 aryl, substituted aryl, heteroaryl, substituted heteroaryl, alkoxy, aryloxy, silyl, boryl,
7 phosphino, amino, thio, seleno, nitro, and combinations thereof; optionally, two or more R^{10} ,
8 R^{11} , R^{12} and R^{13} groups may be joined to form a fused ring system having from 3-50 non-
9 hydrogen atoms; and

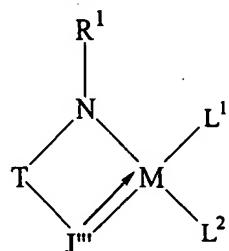
10 R^{14} is selected from the group consisting of hydrogen, alkyl, substituted alkyl, cycloalkyl,
11 substituted cycloalkyl, heteroalkyl, substituted heteroalkyl, heterocycloalkyl, substituted
12 heterocycloalkyl, aryl, substituted aryl, heteroaryl, substituted heteroaryl, alkoxy, aryloxy,
13 silyl, boryl, phosphino, amino, thio, seleno, halide, nitro, and combinations thereof.

1 11. The metal complex of claim 10, wherein said complex is characterized by the general
2 formula:

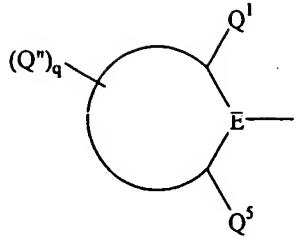


- 3 such that E is carbon and wherein Q², Q³ and Q⁴ are independently selected from the group
 4 consisting of hydrogen, alkyl, substituted alkyl, cycloalkyl, substituted cycloalkyl,
 5 heteroalkyl, substituted heteroalkyl, heterocycloalkyl, substituted heterocycloalkyl, aryl,
 6 substituted aryl, heteroaryl, substituted heteroaryl, alkoxy, aryloxy, silyl, boryl, phosphino,
 7 amino, thio, seleno, nitro, and combinations thereof; optionally two or more of Q², Q³ and Q⁴
 8 are joined together in a ring structure.
 9

1 12. A metal complex characterized by the formula:



- 2 where M is zirconium or hafnium;
 3 wherein R¹ is characterized by the general formula:
 4



5

6 wherein E is either carbon or nitrogen,

7 Q¹ and Q⁵ are substituents on the R¹ ring at a position ortho to E, with Q¹ and Q⁵ are
8 independently selected from the group consisting of alkyl, substituted alkyl, cycloalkyl,
9 substituted cycloalkyl, aryl, substituted aryl and silyl, but provided that Q¹ and Q⁵ are not
10 both methyl;

11 Q''_q represents additional possible substituents on the ring, with q being 1, 2, 3, 4 or 5
12 and Q'' being selected from the group consisting of hydrogen, alkyl, substituted alkyl,
13 cycloalkyl, substituted cycloalkyl, heteroalkyl, substituted heteroalkyl, heterocycloalkyl,
14 substituted heterocycloalkyl, aryl, substituted aryl, heteroaryl, substituted heteroaryl, alkoxy,
15 aryloxyl, silyl, boryl, phosphino, amino, thio, seleno, halide, nitro, and combinations thereof;

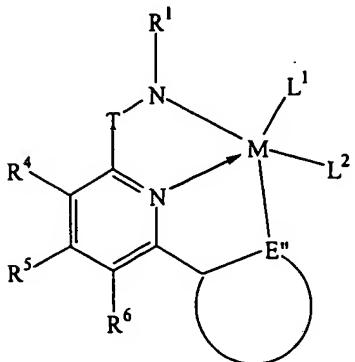
16 T is a bridging group selected group consisting of $-CR^2R^3-$ and $-SiR^2R^3-$ with R²
17 selected from the group consisting of hydrogen, alkyl, substituted alkyl, cycloalkyl,
18 substituted cycloalkyl, heteroalkyl, substituted heteroalkyl, heterocycloalkyl, substituted
19 heterocycloalkyl, aryl, substituted aryl, heteroaryl, substituted heteroaryl, alkoxy, aryloxyl,
20 silyl, boryl, phosphino, amino, thio, seleno, halide, nitro, and combinations thereof; R³
21 selected from the group consisting of aryl, substituted aryl, heteroaryl, and substituted
22 heteroaryl; and provided that R² is different from R³;

23 J'' being selected from the group of substituted heteroaryls with 2 atoms bonded to
24 the metal M, at least one of those 2 atoms being a heteroatom, and with one atom of J'' is
25 bonded to M via a dative bond, the other through a covalent bond; and

26 L¹ and L² are independently selected from the group consisting of halide, alkyl,
27 substituted alkyl, cycloalkyl, substituted cycloalkyl, heteroalkyl, substituted heteroalkyl,
28 heterocycloalkyl, substituted heterocycloalkyl, aryl, substituted aryl, heteroaryl, substituted
29 heteroaryl, alkoxy, aryloxy, hydroxy, boryl, silyl, amino, amine, hydrido, allyl, diene, seleno,
30 phosphino, phosphine, carboxylates, thio, 1,3-dionates, oxalates, carbonates, nitrates,

31 sulphates, ethers, thioethers and combinations thereof or optionally the two L groups are
32 joined into a ring structure.

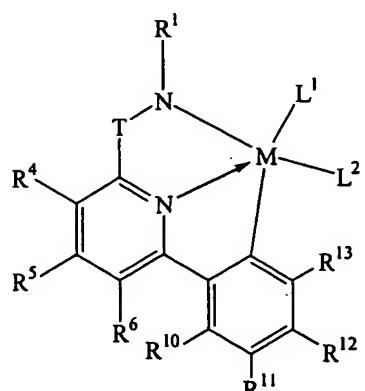
1 13. The complex of claim 12, wherein said complex is characterized by the formula:



2
3 wherein each of R⁴, R⁵ and R⁶ is independently selected from the group consisting of
4 hydrogen, alkyl, substituted alkyl, cycloalkyl, substituted cycloalkyl, heteroalkyl, substituted
5 heteroalkyl, heterocycloalkyl, substituted heterocycloalkyl, aryl, substituted aryl, heteroaryl,
6 substituted heteroaryl, alkoxy, aryloxy, silyl, boryl, phosphino, amino, thio, seleno, halide,
7 nitro, and combinations thereof; and optionally, any combination of R¹, R², R³, R⁴, R⁵, or R⁶
8 may be joined together in a ring structure; and

9 E'' is either carbon or nitrogen and is part of a cyclic aryl, substituted aryl, heteroaryl,
10 or substituted heteroaryl group.

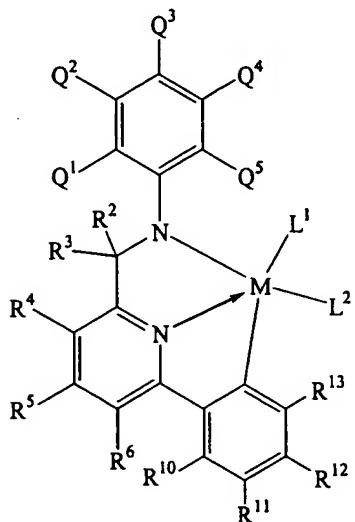
1 14. The metal complex of claim 13, wherein said complex is characterized by the
2 formula:



3
4 wherein R¹⁰, R¹¹, R¹² and R¹³ are each independently selected from the group consisting of

5 hydrogen, halide, alkyl, substituted alkyl, cycloalkyl, substituted cycloalkyl, heteroalkyl,
6 substituted heteroalkyl, heterocycloalkyl, substituted heterocycloalkyl, aryl, substituted aryl,
7 heteroaryl, substituted heteroaryl, alkoxy, aryloxy, silyl, boryl, phosphino, amino, thio,
8 seleno, nitro, and combinations thereof; optionally, two or more R¹⁰, R¹¹, R¹² and R¹³ groups
9 may be joined to form a fused ring system having from 3-50 non-hydrogen atoms.

1 15. The metal complex of claim 14, wherein said complex is characterized by the
2 formula:



3
4 wherein Q², Q³ and Q⁴ are independently selected from the group consisting of hydrogen,
5 alkyl, substituted alkyl, cycloalkyl, substituted cycloalkyl, heteroalkyl, substituted
6 heteroalkyl, heterocycloalkyl, substituted heterocycloalkyl, aryl, substituted aryl, heteroaryl,
7 substituted heteroaryl, alkoxy, aryloxy, silyl, boryl, phosphino, amino, thio, seleno, nitro,
8 and combinations thereof; or optionally, two of Q², Q³ and Q⁴ are joined together in a ring
9 structure.

1 16. The composition or complex of either of claims 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12,
2 13, 14 or 15 wherein R² is hydrogen.

1 17. The composition or complex of claim 16, wherein each of R⁴, R⁵ and R⁶ is
2 hydrogen.

1 18. The composition or complex of claim 17, wherein R³ is selected from the

2 group consisting of benzyl, phenyl, naphthyl, 2-biphenyl, 2-dimethylaminophenyl, 2-
3 methoxyphenyl, anthracenyl, mesityl, 2-pyridyl, 3,5-dimethylphenyl, o-tolyl, and
4 phenanthrenyl.

1 19. The composition or complex of claim 18, wherein Q¹ and Q⁵ are both
2 isopropyl; or both ethyl; or both sec-butyl; or Q¹ is methyl and Q⁵ is isopropyl; or Q¹ is ethyl
3 and Q⁵ is sec-butyl.

1 20. The composition or complex of claim 19, wherein R¹⁰, R¹¹, R¹², R¹³, are each
2 hydrogen; or one or more of R¹⁰, R¹¹, R¹², R¹³ are methyl, fluoro, trifluoromethyl, methoxy,
3 or dimethylamino; or R¹⁰ and R¹¹ are joined to form a benzene ring and R¹² and R¹³ are each
4 hydrogen.

1 21. The composition or complex of either of claims 2, 3, 8, 9, 13 or 14, wherein
2 each of R⁴ and R⁵ is hydrogen and R⁶ is either hydrogen or is joined to R⁷ to form a fused ring
3 system.

1 22. The composition or complex of either of claims 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12,
2 13, 14 or 15, wherein R³ is selected from the group consisting of benzyl, phenyl, naphthyl,
3 2-biphenyl, 2-dimethylaminophenyl, 2-methoxyphenyl, anthracenyl, mesityl, 2-pyridyl,
4 3,5-dimethylphenyl, o-tolyl, and phenanthrenyl.

1 23. The composition or complex of either of claims 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12,
2 13, 14 or 15 wherein Q¹ and Q⁵ are, independently, selected from the group consisting of –
3 CH₂R¹⁵, –CHR¹⁶R¹⁷ and methyl, provided that not both Q¹ and Q⁵ are methyl, wherein R¹⁵ is
4 selected from the group consisting of alkyl, substituted alkyl, aryl and substituted aryl; R¹⁶
5 and R¹⁷ are independently selected from the group consisting of alkyl, substituted alkyl, aryl
6 and substituted aryl; and optionally R¹⁶ and R¹⁷ are joined together in a ring structure having
7 from 3-50 non-hydrogen atoms .

1 24. The composition or complex of claim 23, wherein Q², Q³, and Q⁴ are each
2 hydrogen and Q¹ and Q⁵ are both isopropyl; or both ethyl; or both sec-butyl; or Q¹ is methyl
3 and Q⁵ is isopropyl; or Q¹ is ethyl and Q⁵ is sec-butyl.

1 25. The composition or complex of either of claims 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12,

2 13, 14 or 15, wherein R¹ or the variables Q¹, Q², Q³, Q⁴ and Q⁵ are chosen so that the R¹
3 moiety is selected from the group consisting of 2,6-(Pr^j)₂-C₆H₃-; 2-Pr^j-6-Me-C₆H₃-;
4 2,6-Et₂-C₆H₃-; and 2-sec-butyl-6-Et-C₆H₃-.

1 26. The composition or complex of either of claims 2, 3, 8 or 9, wherein R⁷ is aryl,
2 substituted aryl, heteroaryl or substituted heteroaryl.

1 27. The composition or complex of claim 26, wherein R⁷ is selected from the
2 group consisting of phenyl, naphthyl, mesityl, anthracenyl and phenanthrenyl.

1 28. The composition or complex of either of claims 4, 5, 10 or 11, wherein R¹⁰,
2 R¹¹, R¹², R¹³, are each hydrogen; or one or more of R¹⁰, R¹¹, R¹², R¹³ are methyl, fluoro,
3 trifluoromethyl, methoxy, or dimethylamino; or R¹⁰ and R¹¹ are joined to form a benzene ring
4 and R¹² and R¹³ are each hydrogen.

1 29. The composition or complex of either of claims 2, 3, 4, 5, 8, 9, 10, 11, 13, 14
2 or 15, wherein two or more of R⁴, R⁵, R⁶ and R⁷ is joined to form a fused ring system having
3 from 3-50 non-hydrogen atoms in addition to the pyridine ring and/or R⁴, R⁵ and R⁶ are each
4 independently selected from the group consisting of alkyl, aryl, halide, alkoxy, aryloxy,
5 amino, and thio.

1 30. The composition or complex of either of claims 4, 5, 10, 11 or 15, wherein R⁶
2 and R¹⁰ are joined to form a ring system having from 5-50 non-hydrogen atoms.

1 31. A process for the stereospecific polymerization of an alpha-olefin, comprising
2 polymerizing at least one alpha-olefin in the presence of a chiral complex characterized by
3 either of claims 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 or 15, optionally in the presence of
4 one or more activators, under polymerization conditions.

1 32. The process of claim 31, wherein said alpha olefin is propylene.

1 33. The process of claim 31, further comprising providing a reactor with at least
2 one polymerizable monomer and providing a composition or catalyst to said reactor.

1 34. Isotactic polypropylene produced by polymerization of propylene with the aid
2 of a catalyst that comprises Hf or Zr in a solution polymerization process, wherein the

3 tacticity index value of the polypropylene does not vary by more than 0.1 when the
4 temperature of the solution process is varied from a temperature below 90°C to a temperature
5 above 100°C.

1 35. Isotactic polypropylene produced by polymerization of propylene with the
2 with the aid of a catalyst that comprises Hf or Zr in a solution polymerization process,
3 wherein the melting point of the polypropylene does not vary by more than 10°C when the
4 temperature of the solution process is varied from a temperature below 90°C to a temperature
5 above 100°C.

1 36. Isotactic polypropylene produced by polymerization of propylene with the
2 with the aid of a catalyst that comprises Hf or Zr in a solution polymerization process,
3 wherein the temperature of the solution process is at least 110°C and the polypropylene has a
4 weight average molecular weight of at least 100,000.

1 37. The isotactic polypropylene of either of claims 34 or 35, wherein said solution
2 process is operated at a temperature at or above 110°C.

1 38. The isotactic polypropylene of either of claims 34, 35 or 36, wherein said
2 catalyst is formed from the composition of claim 1.

1 39. The isotactic polypropylene of either of claims 34, 35 or 36, wherein said
2 catalyst is formed from the composition of claim 2.

1 40. The isotactic polypropylene of either of claims 34, 35 or 36, wherein said
2 catalyst is formed from the composition of claim 3.

1 41. The isotactic polypropylene of either of claims 34, 35 or 36, wherein said
2 catalyst is formed from the composition of claim 4.

1 42. The isotactic polypropylene of either of claims 34, 35 or 36, wherein said
2 catalyst is formed from the composition of claim 5.

1 43. The isotactic polypropylene of either of claims 34, 35 or 36, wherein said
2 catalyst is formed from the complex of claim 6.

1 44. The isotactic polypropylene of either of claims 34, 35 or 36, wherein said
2 catalyst is formed from the complex of claim 7.

1 45. The isotactic polypropylene of either of claims 34, 35 or 36, wherein said
2 catalyst is formed from the complex of claim 8.

1 46. The isotactic polypropylene of either of claims 34, 35 or 36, wherein said
2 catalyst is formed from the complex of claim 9.

1 47. The isotactic polypropylene of either of claims 34, 35 or 36, wherein said
2 catalyst is formed from the complex of claim 10.

1 48. The isotactic polypropylene of either of claims 34, 35 or 36, wherein said
2 catalyst is formed from the complex of claim 11.

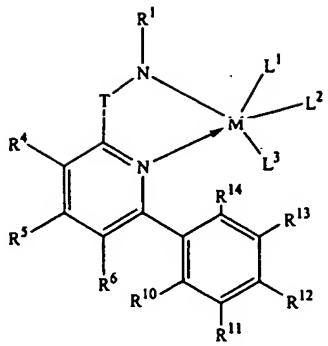
1 49. The isotactic polypropylene of either of claims 34, 35 or 36, wherein said
2 catalyst is formed from the complex of claim 12.

1 50. The isotactic polypropylene of either of claims 34, 35 or 36, wherein said
2 catalyst is formed from the complex of claim 13.

1 51. The isotactic polypropylene of either of claims 34, 35 or 36, wherein said
2 catalyst is formed from the complex of claim 14.

1 52. The isotactic polypropylene of either of claims 34, 35 or 36, wherein said
2 catalyst is formed from the complex of claim 15.

1 53. A process for polymerizing propylene to crystalline polypropylene in a
2 solution process, comprising contacting propylene monomer with a catalyst comprising a
3 metal-ligand complex combined with an activator, combination of activators or activating
4 technique, wherein at least one of said activators is a group 13 reagent and said metal-ligand
5 complex is characterized by the formula:



6

7 where M is zirconium or hafnium;

8 L^1 , L^2 and L^3 are independently selected from the group consisting of halide, alkyl,
9 substituted alkyl, cycloalkyl, substituted cycloalkyl, heteroalkyl, substituted heteroalkyl,
10 heterocycloalkyl, substituted heterocycloalkyl, aryl, substituted aryl, heteroaryl, substituted
11 heteroaryl, alkoxy, aryloxy, hydroxy, boryl, silyl, amino, amine, hydrido, allyl, diene, seleno,
12 phosphino, phosphine, carboxylates, thio, 1,3-dionates, oxalates, carbonates, nitrates,
13 sulphates, ethers, thioethers and combinations thereof or optionally two or more L groups are
14 joined into a ring structure;

15 R^1 is selected from the group consisting of $2,6-(Pr^i)_2-C_6H_3-$; $2-Pr^i-6-Me-C_6H_3-$;
16 $2,6-Et_2-C_6H_3-$; or $2\text{-sec\text{-}butyl}-6-Et-C_6H_3-$;

17 T is a bridging group selected group consisting of $-CR^2R^3-$ and $-SiR^2R^3-$;

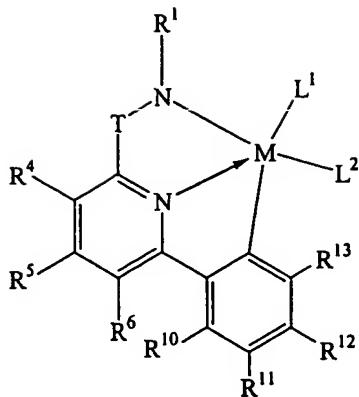
18 R^3 is selected from the group consisting of aryl and substituted aryl;

19 R^2 , R^4 , R^5 and R^6 are hydrogen;

20 either R^{10} , R^{11} , R^{12} , R^{13} , are each hydrogen; or one or more of R^{10} , R^{11} , R^{12} , R^{13} are
21 methyl, fluoro, trifluoromethyl, methoxy, or dimethylamino; or R^{10} and R^{11} are joined to
22 form a benzene ring and R^{12} and R^{13} are each hydrogen; and

23 R^{14} is either hydrogen or methyl.

1 54. A process for polymerizing propylene to crystalline polypropylene in a
2 solution process, comprising contacting propylene monomer with a catalyst comprising a
3 metal-ligand complex combined with an activator, combination of activators or activating
4 technique, wherein at least one of said activators is a group 13 reagent and said metal-ligand
5 complex is characterized by the formula:



6

7 where M is zirconium or hafnium;

8 L¹ and L² are independently selected from the group consisting of halide, alkyl,
9 substituted alkyl, cycloalkyl, substituted cycloalkyl, heteroalkyl, substituted heteroalkyl,
10 heterocycloalkyl, substituted heterocycloalkyl, aryl, substituted aryl, heteroaryl, substituted
11 heteroaryl, alkoxy, aryloxy, hydroxy, boryl, silyl, amino, amine, hydrido, allyl, diene, seleno,
12 phosphino, phosphine, carboxylates, thio, 1,3-dionates, oxalates, carbonates, nitrates,
13 sulphates, ethers, thioethers and combinations thereof or optionally the two L groups are
14 joined into a ring structure;

15 R¹ is selected from the group consisting of 2,6-(Pr¹)₂-C₆H₃-; 2-Pr¹-6-Me-C₆H₃-;
16 2,6-Et₂-C₆H₃-; or 2-sec-butyl-6-Et-C₆H₃-;

17 T is a bridging group selected group consisting of -CR²R³- and -SiR²R³-;

18 R³ is selected from the group consisting of aryl and substituted aryl;

19 R², R⁴, R⁵ and R⁶ are hydrogen; and

20 either R¹⁰, R¹¹, R¹², R¹³, are each hydrogen; or one or more of R¹⁰, R¹¹, R¹², R¹³ are
21 methyl, fluoro, trifluoromethyl, methoxy, or dimethylamino; or R¹⁰ and R¹¹ are joined to
22 form a benzene ring and R¹² and R¹³ are each hydrogen.

1